REMARKS

Reconsideration and allowance of the above-identified application are respectfully requested.

Claims 32-115 are currently pending, wherein claims 32, 41, 50, 51, 60, 69, 70, 99, 102, 103, 107, 110 and 112 are independent.

Applicant notes with appreciation the acknowledgment by the Patent Office of the Information Disclosure Statement submitted on April 15, 2004.

I. OBJECTION TO DRAWINGS

Applicant notes with appreciation the acceptance by the Patent Office of the drawings filed on April 15, 2004. Applicant hereby submits one (1) sheet of formal drawing for Figure 7A, marked "REPLACEMENT SHEET", for review by the Patent Office in connection with the above-identified application. Should the enclosed drawing require further changes, it is respectfully submitted that the Patent Office notify the undersigned of same.

II. 35 U.S.C. § 112, FIRST PARAGRAPH REJECTIONS

In the sixth section of the Office Action, claims 32, 34, 41, 50, 51, 60, 69, 70, 79, 81, 83, 85, 87, 89, 91, 93, 95, 97, 99, 100, 102, 103, 105, 107, 110, 112 and 114 are rejected under 35 U.S.C. § 112, first paragraph, for allegedly failing to comply with the written description requirement. This rejection is respectfully traversed.

According to established principles of the patent laws, "[t]here is a *strong* presumption that an adequate written disclosure of the claimed invention is present when the application is filed." [M.P.E.P. § 2163 (citations omitted) (emphasis added)] "Consequently, rejection of an original claim for lack of written description should be *rare*." [M.P.E.P. § 2163 (emphasis added)] Accordingly, "[a]n applicant shows possession of the claimed invention by describing the claimed invention with all of its limitations using such descriptive means as words, structures, figures, diagrams, and formulas that fully set forth the claimed invention." [M.P.E.P. § 2163 (citations omitted)]

The attention of the Patent Office is directed to Figures 5 and 6 of the present application. As disclosed by the present application,

> [t] o meet the severe receiver requirements of the gigabit Ethernet, the near-end echo/near-end crosstalk canceller of this invention has a correlator **100** of Fig. 3 that creates each coefficient C_0, ..., C_j **125** of the FIR filter **105** that is the function of the previous coefficient. Each coefficient C_0, ..., C_j **125** is the weighted sum of the previous coefficient and *the received signal X(k) 115* multiplied by a time delayed version of the transmitted symbol **b(k) 120** and is summarized as follows:
>
> $$C_J(k+1) = (1-\beta) * C_J(k) + \frac{\beta}{\sigma^2} * x(k) * b(k-j) \qquad \textbf{EQ. 1}$$
>
> where:
>
> $C_j(k)$ is the previous coefficient.
> $Cj(k+1)$ is the filter coefficient for the FIR filter for the next received signal.
> $X(k)$ *is the present received signal.*
> $b(k-j)$ is the transmitted signal delayed by j delay units.
> σ^2 is the variance of the transmitted symbol. For gigabit Ethernet $\sigma^2 = 2$.
> β is a weighting factor.
> [present application, page 18, lines 9-21 (emphasis added)]

Based on the foregoing disclosure, it is respectfully submitted that the feature of "the plurality of filter coefficients for a current time period are a weighted sum of corresponding coefficients from a previous time period and a product of *a signal received by the receiver during the current period* and a signal transmitted by the transmitter delayed by a predetermined time," recited in, for example, claim 32 of the present application is clearly and adequately described in the present application, in full and complete compliance with the patent laws, particularly, 35 U.S.C. § 112, first paragraph

Contrary to the assertions of the Patent Office, it is respectfully submitted that the Patent Office misunderstands, misconstrues and misinterprets the claims and specification of the present application. It is respectfully submitted that the Patent Office is reading unsupported and unfounded limitations into the claims and specification of the present application, and reading into the specification and drawings quotations not attributable to the Applicant, in complete contradistinction to established Patent Laws. Accordingly, reconsideration and withdrawal of these grounds of rejection are respectfully requested.

If this rejection is repeated, the Patent Office is requested to specifically point out the exact words and/or sentences of the present application that support the Patent Office's unfounded and unsupported assertion that the plurality of filter coefficients for a current time period are formed from, among other terms, a product using a signal received by the receiver during the *previous* time period.

In addition, the Patent Office has noted that for purposes of the present Office Action, the Patent Office assumes that the signal received by the receiver is the signal received during the previous time period. Applicant respectfully submits that the Patent Office's assumption

is unfounded and without support, and respectfully requests that the Patent Office's assumption be withdrawn.

III. UNDUE MULTIPLICITY OBJECTIONS

In the seventh section of the Office Action, claims 40, 46, 49, 56, 59, 65, 68, 75, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 101, 106, 109, 111 and 115 are objected to under 37 C.F.R. § 1.75 as allegedly being substantial duplicates of claim 37. This rejection is respectfully traversed.

Applicant respectfully notes that "court decisions have confirmed applicant's right to restate (i.e., by plural claiming) the invention in a reasonable number of ways. Indeed, *a mere difference in scope between claims has been held to be enough.*" [M.P.E.P. § 706.03(k) (emphasis added)] In addition, "applicants should be allowed reasonable latitude in stating their claims in regard to number and phraseology employed. The right of applicants to freedom of choice in selecting phraseology which truly points out and defines their inventions *should not be abridged.*" [M.P.E.P. § 2173.05(n), citing *In re Chandler*, 319 F.2d 211, 225 (C.C.P.A. 1963) (emphasis added)]

Applicant further respectfully notes that it is a fundamental tenet of U.S. patent law that a dependent claim incorporates by reference every limitation of the claim from which it depends. [*see* 35 U.S.C. § 112, fourth paragraph]

For the convenience of the Patent Office, the following Table 1 lists pending claim 40 of the present application (including claims 32 and 38 from which it depends) and pending claim 37 (including claims 32 and 35 from which it depends):

TABLE 1

Claim 40 of Present Application (including Claims 32 and 38 from which Claim 40 depends)	Claim 37 of Present Application (including Claims 32 and 35 from which Claim 37 depends)
32. An apparatus to remove echo and crosstalk interference in a communication system having a receiver and a transmitter for simultaneous reception from and transmission to a communication medium, said apparatus comprising: an adaptive correlator in communication with the communication medium to generate a plurality of filter coefficients each period of time representing echo and crosstalk interference on a signal received by the receiver, wherein the plurality of filter coefficients for a current time period are a weighted sum of corresponding coefficients from a previous time period and a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time; and a finite impulse filter in communication with the receiver to filter the echo and crosstalk in accordance with the plurality of filter coefficients generated by said adaptive correlator.	32. An apparatus to remove echo and crosstalk interference in a communication system having a receiver and a transmitter for simultaneous reception from and transmission to a communication medium, said apparatus comprising: an adaptive correlator in communication with the communication medium to generate a plurality of filter coefficients each period of time representing echo and crosstalk interference on a signal received by the receiver, wherein the plurality of filter coefficients for a current time period are a weighted sum of corresponding coefficients from a previous time period and a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time; and a finite impulse filter in communication with the receiver to filter the echo and crosstalk in accordance with the plurality of filter coefficients generated by said adaptive correlator.
38. An apparatus according to Claim 32, wherein said adaptive correlator comprises: a first delay circuit to delay the signal transmitted by the transmitter; a first shifter to shift the signal received by the receiver during the current period in accordance with an output of said first delay circuit; a second shifter to shift an output of said first shifter in accordance with a first predetermined weighting factor; a first adder; a third shifter to shift an output of said first adder in accordance with a second	35. An apparatus according to Claim 32, wherein said adaptive correlator comprises: a first delay circuit to delay the signal transmitted by the transmitter; a first multiplier to multiply the signal received by the receiver during the current period with an output of said first delay circuit; a second multiplier to multiply an output of said first multiplier by a first predetermined weighting factor; a first adder; a second delay circuit to delay an

predetermined weighting factor; a second adder; and a second delay circuit to delay an output of said second adder, wherein said first adder adds an output of said second shifter to an output of said second delay circuit, and wherein said second adder adds an output of said third shifter to the output of said second delay circuit. 40. An apparatus according to Claim 38, wherein the second predetermined weighting factor is an inverse of a number of groups of the signals transmitted by the transmitter.	output of said first adder; and a third multiplier to multiply an output of said second delay circuit by a second predetermined weighting factor, wherein said first adder adds an output of said second multiplier to an output of said third multiplier. 37. An apparatus according to Claim 35, wherein the second predetermined weighting factor is an inverse of a number of a group of the signals transmitted by the transmitter.

Given the recitation of the claims in Table 1, Applicant respectfully submits that the Patent Office is *ignoring* the recitation of the features in the claims from which claim 40 depends, when making the unfounded assertion that there is a "slight" difference in wording between claim 40 and claim 37. [*see, e.g.*, present application, claims 35 and 38] Applicant respectfully submits that the Patent Office is similarly fundamentally misinterpreting and misconstruing claims 46, 49, 56, 59, 65, 68, 75, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 101, 106, 109, 111 and 115 with respect to claim 37.

Given the "reasonable latitude" allowed to Applicant in stating the claims in regard to number and phraseology employed, it is respectfully submitted that claims 40, 46, 49, 56, 59, 65, 68, 75, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 101, 106, 109, 111 and 115 are not substantial duplicates of claim 37 and are not unduly multiplicative. Accordingly, reconsideration and withdrawal of these grounds of objection are respectfully requested.

In the eighth section of the Office Action, claims 39, 45, 48, 55, 58, 64, 67, 74 and 77 are objected to under 37 C.F.R. § 1.75 as allegedly being substantial duplicates of claim 36. This rejection is respectfully traversed.

For the convenience of the Patent Office, the following Table 2 lists pending claim 39 (including claims 32 and 38 from which it depends) and pending claim 36 (including claims 32 and 35 from which it depends):

TABLE 2

Claim 39 of Present Application (including Claims 32 and 38 from which Claim 39 depends)	**Claim 36 of Present Application (including Claims 32 and 35 from which Claim 36 depends)**
32. An apparatus to remove echo and crosstalk interference in a communication system having a receiver and a transmitter for simultaneous reception from and transmission to a communication medium, said apparatus comprising: an adaptive correlator in communication with the communication medium to generate a plurality of filter coefficients each period of time representing echo and crosstalk interference on a signal received by the receiver, wherein the plurality of filter coefficients for a current time period are a weighted sum of corresponding coefficients from a previous time period and a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time; and a finite impulse filter in communication with the receiver to filter the echo and crosstalk in accordance with the plurality of filter coefficients generated by said adaptive correlator.	32. An apparatus to remove echo and crosstalk interference in a communication system having a receiver and a transmitter for simultaneous reception from and transmission to a communication medium, said apparatus comprising: an adaptive correlator in communication with the communication medium to generate a plurality of filter coefficients each period of time representing echo and crosstalk interference on a signal received by the receiver, wherein the plurality of filter coefficients for a current time period are a weighted sum of corresponding coefficients from a previous time period and a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time; and a finite impulse filter in communication with the receiver to filter the echo and crosstalk in accordance with the plurality of filter coefficients generated by said adaptive correlator.
38. An apparatus according to Claim 32, wherein said adaptive correlator comprises:	35. An apparatus according to Claim 32, wherein said adaptive correlator

a first delay circuit to delay the signal transmitted by the transmitter; a first shifter to shift the signal received by the receiver during the current period in accordance with an output of said first delay circuit; a second shifter to shift an output of said first shifter in accordance with a first predetermined weighting factor; a first adder; a third shifter to shift an output of said first adder in accordance with a second predetermined weighting factor; a second adder; and a second delay circuit to delay an output of said second adder, wherein said first adder adds an output of said second shifter to an output of said second delay circuit, and wherein said second adder adds an output of said third shifter to the output of said second delay circuit. 39. An apparatus according to Claim 38, wherein the first predetermined weighting factor is an inverse of a variance of the signal transmitted by the transmitter.	comprises: a first delay circuit to delay the signal transmitted by the transmitter; a first multiplier to multiply the signal received by the receiver during the current period with an output of said first delay circuit; a second multiplier to multiply an output of said first multiplier by a first predetermined weighting factor; a first adder; a second delay circuit to delay an output of said first adder; and a third multiplier to multiply an output of said second delay circuit by a second predetermined weighting factor, wherein said first adder adds an output of said second multiplier to an output of said third multiplier. 36. An apparatus according to Claim 35, wherein the first predetermined weighting factor is a quotient of the second predetermined weighting factor divided by a variance of the signal transmitted by the transmitter.

Given the recitation of the claims in Table 2, Applicant again respectfully submits that the Patent Office is *ignoring* the recitation of the features in the claims from which claim 39 depends, when making the unfounded assertion that there is a "slight" difference in wording between claim 39 and claim 36. [*see, e.g.*, present application, claims 35 and 38] Applicant respectfully submits that the Patent Office is similarly fundamentally misinterpreting and misconstruing claims 45, 48, 55, 58, 64, 67, 74 and 77 with respect to claim 36.

Given the "reasonable latitude" allowed to Applicant in stating the claims in regard to number and phraseology employed, it is respectfully submitted that claims 39, 45, 48, 55, 58,

64, 67, 74 and 77 are not substantial duplicates of claim 36 and are not unduly multiplicative. Accordingly, reconsideration and withdrawal of these grounds of objection are respectfully requested.

In the ninth section of the Office Action, claims 81, 83, 85, 87, 89, 91, 93, 95, 97, 100, 105 and 114 are objected to under 37 C.F.R. § 1.75 as allegedly being a substantial duplicate of claim 79. This rejection is respectfully traversed.

For the convenience of the Patent Office, the following Table 3 lists pending claim 81 of the present application (including claim 41 of the present application from which it depends) and pending claim 79 (including claim 32 of the present application from which it depends):

TABLE 3

Claim 81 of Present Application (including Claim 41 from which Claim 81 depends)	**Claim 79 of Present Application (including Claim 32 from which Claim 79 depends)**
41. A communication apparatus comprising: a transmitter; a receiver; an adaptive correlator in communication with a communication medium to generate a plurality of filter coefficients each period of time representing echo and crosstalk interference on a signal received by said receiver, wherein the plurality of filter coefficients for a current time period are a weighted sum of corresponding coefficients from a previous time period and a product of a signal received by said receiver during the current period and a signal transmitted by said transmitter delayed by a predetermined time; and a finite impulse filter in communication with said receiver to filter the echo and crosstalk in accordance with the plurality of filter coefficients generated by said adaptive correlator, wherein said receiver receives a	32. An apparatus to remove echo and crosstalk interference in a communication system having a receiver and a transmitter for simultaneous reception from and transmission to a communication medium, said apparatus comprising: an adaptive correlator in communication with the communication medium to generate a plurality of filter coefficients each period of time representing echo and crosstalk interference on a signal received by the receiver, wherein the plurality of filter coefficients for a current time period are a weighted sum of corresponding coefficients from a previous time period and a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time; and a finite impulse filter in communication with the receiver to filter the echo and crosstalk in accordance with the plurality of filter coefficients

signal from said finite impulse filter simultaneously with the transmission of a signal by said transmitter on the medium. 81. The apparatus according to Claim 41, wherein each of the plurality of filter coefficients are generated according to the formula: $C_J(k+1) = (1-\beta) * C_J(k) + \frac{\beta}{\sigma^2} * x(k+1) * b(k-j)$ wherein: **$C_j(k)$** is the filter coefficient from the previous time period, **Cj(k+1)** is the filter coefficient for the current time period, **x(k+1)** is the signal received by the receiver during the current period, **b(k-j)** is the signal transmitted by the transmitter delayed by **j** delay units, **(1-β)** is a first leakage factor, σ^2 is a variance of a transmitted symbol, and β/σ^2 is a second leakage factor.	generated by said adaptive correlator. 79. The apparatus according to Claim 32, wherein each of the plurality of filter coefficients are generated according to the formula: $C_J(k+1) = (1-\beta) * C_J(k) + \frac{\beta}{\sigma^2} * x(k+1) * b(k-j)$ wherein: **$C_j(k)$** is the filter coefficient from the previous time period, **Cj(k+1)** is the filter coefficient for the current time period, **x(k+1)** is the signal received by the receiver during the current period, **b(k-j)** is the signal transmitted by the transmitter delayed by **j** delay units, **(1-β)** is a first leakage factor, σ^2 is a variance of a transmitted symbol, and β/σ^2 is a second leakage factor.

Given the recitation of the claims in Table 3, Applicant again respectfully submits that the Patent Office is *ignoring* the recitation of the features in the claims from which claim 81 depends, when making the unfounded assertion that there is a "slight" difference in wording between claim 81 and claim 79. [*see, e.g.*, present application, claims 32 and 41] Applicant respectfully submits that the Patent Office is similarly fundamentally misinterpreting and misconstruing claims 83, 85, 87, 89, 91, 93, 95, 97, 100, 105 and 114 with respect to claim 79.

Given the "reasonable latitude" allowed to Applicant in stating the claims in regard to number and phraseology employed, it is respectfully submitted that claims 81, 83, 85, 87, 89,

91, 93, 95, 97, 100, 105 and 114 are not substantial duplicates of claim 79 and are not unduly multiplicative. Accordingly, reconsideration and withdrawal of these grounds of objection are respectfully requested.

IV. 35 U.S.C. § 103(a) REJECTIONS BASED ON HIRANO AND SUGIYAMA

In the eleventh section of the Office Action, claims 32-35, 38, 41-44, 47, 50, 51-54, 57, 60-63, 66, 69, 70-73, 76, 79, 81, 83, 85, 87, 89, 91, 93, 95, 97, 99, 100, 102, 103-105, 107-108, 110 and 112-114 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Hirano et al. (U.S. Patent No. 5,396,554, hereinafter "Hirano") in view of Sugiyama (U.S. Patent No. 6,442,274, hereinafter "Sugiyama"). This rejection is respectfully traversed.

Exemplary embodiments of the present invention are directed to an apparatus for canceling near-end echo and near-end crosstalk in a receiver of a communication system having simultaneous transmission and receiving on a communication medium. The apparatus includes an adaptive correlator and a finite impulse response filter. The adaptive correlator is connected to a receiving circuit to acquire received signals from the communication medium. The adaptive correlator is also connected to at least one of a plurality of transmission channels of the communication system to acquire at least one transmitted signal from the adjacent transmission channels. The adaptive correlator is configured to generate a plurality of filter coefficients for reproducing the echo response of the received signals to near-end echo and near-end crosstalk interference from the transmitted signals at the arrival of each received signal. Each new filter coefficient comprises a weighted sum of a previous

coefficient and a received signal received during the current time period multiplied by a time delayed version of a transmitted signal. More particularly, the previous coefficient is weighted by a first leakage factor, and the product of the received signal and the time-delayed transmitted signal is weighted by a second leakage factor.

The finite impulse filter is connected to the receiving circuit to acquire the received signals, and is connected to the adaptive correlator to receive the plurality of filter coefficients. The finite impulse filter is configured to reproduce the near-end echo and near-end crosstalk signals from the received signals based on the values of the plurality of filter coefficients. The reproduced near-end echo and near-end crosstalk signals are combined with the received signals to cancel any echo and crosstalk interference from the received signals.

In contrast to the present invention, Hirano discloses an echo canceling method and apparatus for subtracting a replica of the echoes from a mixed signal in which echoes produced from a plurality of reception signals are mixed with a transmission signal, in order to cancel the echoes in the mixed signal. The replica of the echoes are generated by selecting the reception signal which is leading in phase and producing a replica of the echoes from the selected reception signal by an adaptive filter. As shown in Equations 24 and 25, the coefficients of the adaptive filters are updated according to a conventional LMS algorithm, in which each new filter coefficient is the sum of the previous coefficient and a product of an input signal, an error signal and a fixed step size (μ). [*see* Hirano, column 10, lines 13-45]

However, the Patent Office notes that "[i]nherently, Hirano teaches an adaptation algorithm. For example, Bonnet et al. [US 4,852,081] shows a typical form of an adaptation algorithm . . . ." [Office Action, page 3] Applicant does not disagree with the Patent Office that Hirano teaches an adaptation algorithm – Hirano merely teaches *a conventional LMS*

algorithm for updating tap weight coefficients. Additionally, according to Bonnet, the filter coefficients are updated according to Equation 4 or 5, which are also conventional LMS algorithms, in which each new filter coefficient is the sum of the previous coefficient and a product of an input signal, an error signal and a fixed step size (μ). [*See* Bonnet, column 2, lines 14-53]

The Patent Office notes that Hirano discloses that

> [w]hile the multi-channel echo canceling apparatus 100 shown in FIG. 3 is described by way of an example in which the first and second reception signals 11 and 12 and the first and second mixed signals 24 and 25 are involved, the present invention can be applied to other cases in which a plurality of reception signals and a single transmission signal or a plurality of transmission signals are involved. [Hirano, column 17, lines 13-20]

Although the invention disclosed by Hirano can be applied to other cases, it is respectfully submitted that neither this excerpt nor any other disclosure from Hirano discloses or suggests the feature of an adaptive correlator that generates new filter coefficients from a weighted sum of corresponding coefficients from a previous time period and *a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time*, as recited in, for example, claim 32 of the present application.

Sugiyama discloses an echo canceling apparatus suitable for multiplexed transmission lines that achieves a short convergence time and a small number of arithmetic operations. Adaptive filters are located in respective transmission lines. According to Sugiyama, each adaptive filter adaptively controls tap positions such that tap coefficients are located in dispersive regions that are obtained by removing fixed delays from the impulse response in an echo path. A controller receives tap position information from the adaptive filters to

mutually compare the convergence degrees among the adaptive filters. Thus, the controller respectively supplies coefficient update control signals to the adaptive filters so as to suppress coefficient adaptation of an adaptive filter whose convergence is leading compared with the others. [*see* Sugiyama, Abstract]

According to Sugiyama,

> [t]he controller 70 evaluates the *step size* 601 from the adaptive filter 80, the *step size* 603 from the adaptive filter 81, and the *step size* 605 from the adaptive filter 82. Each of the adaptive filters 80, 81 and 82 adaptively controls the *step size* to improve the noise resistants or to reduce the convergence time. Now, it is assumed that, at the time k, the *step sizes* 601, 603 and 605 are $\mu_1(k)$, $\mu_2(k)$ and $\mu_3(k)$, respectively. The controller 70 first averages the *step sizes* to find average *step sizes* μ_1 bar (k), μ_2 bar (k) and μ_3 bar (k). There are some averaging methods. For instance, an averaging method using a first-order leaky integration is expressed by:
>
> $$\overline{\mu}_1(k+1) = \gamma\overline{\mu}_1(k) + (1-\gamma)\mu_1(k) \qquad (1)$$
>
> and that using moving average is expressed by:
>
> $$\overline{\mu}_1(k+1) = \frac{1}{N_A}\sum_{j=k-N_A+2}^{k+1}\mu_1(j) \qquad (2)$$
>
> where γ is a constant satisfying $0<\gamma<1$ and N_A is the window length for moving average. These averaging methods are applicable to μ_2 bar (k) and μ_3 bar (k). [Sugiyama, column 4, lines 42-66 (emphasis added)]

Thus, Sugiyama discloses a first-order leaky integration averaging method for adaptively controlling the *step sizes* of the adaptive filter. Contrary to the assertions of the Patent Office, Sugiyama discloses that either a conventional LMS algorithm or a normalized LMS algorithm is used as the coefficient update algorithm: "the *LMS algorithm* has been assumed for coefficient adaptation. However, other algorithms may be used in the present invention.

For instance, the eighteenth embodiment can be implemented by using the *normalized LMS (NLMS) algorithm* . . . ." [Sugiyama, column 21, lines 46-51 (emphasis added)]

Consequently, as Sugiyama does not disclose or suggest the feature of an adaptive correlator that generates a plurality of filter coefficients for canceling near-end echo and near-end crosstalk, in which each new filter coefficient is a weighted sum of corresponding coefficients from a previous time period and *a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time*, it is respectfully submitted that Sugiyama does not address the above-identified deficiencies of Hirano (or Bonnet).

As neither Hirano nor Sugiyama discloses or suggests the feature of an adaptive correlator that generates new filter coefficients from a weighted sum of corresponding coefficients from a previous time period and *a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time*, it is respectfully submitted that the combination of Hirano and Sugiyama does not render the subject matter of claim 32 obvious.

Furthermore, according to M.P.E.P. § 2143, to establish a prima facie case of obviousness, three basic criteria must be met. "First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings." [M.P.E.P. § 2143] In other words, "[o]bviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the

references themselves or in the knowledge generally available to one of ordinary skill in the art." [M.P.E.P. § 2143.01]

The Patent Office asserts that "it would have been obvious to a person of ordinary skill in the art to apply the first-order leaky integration to the coefficient of the LMS algorithm of Hirano et al in order to obtain a stable value (i.e., **averaged value**) of the LMS coefficient in the presence of noise in an echo cancellation system." [present Office Action, page 7 (emphasis in original)] It is respectfully submitted that there is absolutely no suggestion or motivation, either implicitly or explicitly, to combine Hirano and Sugiyama in the manner suggested by the Patent Office.

Sugiyama discloses that "[t]he step-size controller 106 recursively computes the step size to improve the noise resistance in the adaptive coefficient control." [Sugiyama, column 6, lines 1-3] According to Sugiyama, "noises with large power may cause erroneous coefficient adaptation." [Sugiyama, column 6, lines 11-12] Consequently, "[t]o overcome such a problem, the step size is decreased when the power of noises is large." [Sugiyama, column 6, lines 13-14] Thus, contrary to the assertions of the Patent Office, Sugiyama discloses the use of a "first-order leaky integration" averaging method to update the *step size* used in the LMS algorithm to combat problems associated with noise. The "first-order leaky integration" averaging techniques are applied to the step-size to improve the noise resistance in the adaptive coefficient control. [*see* Sugiyama, column 7, lines 3-5] It is respectfully submitted that Sugiyama does not disclose or suggest the use of the "first-order leaky integration" averaging method to update the tap weight coefficients of the LMS algorithm to obtain average values of the LMS coefficients. Rather, a conventional LMS or NLMS algorithm is used to update the tap weight coefficients.

In addition, it is respectfully submitted that *nowhere* does Hirano, either explicitly or implicitly, disclose or suggest a need or desire to use such an adaptive step size in the LMS algorithm to combat noise. As discussed previously, it is respectfully submitted that there is no support in Sugiyama or Hirano, either explicitly or implicitly, for the Patent Office's alleged motivation to apply the first-order leaky integration averaging method to the coefficients of the LMS algorithm to obtain a stable (i.e., averaged) value of the LMS coefficients in the presence of noise in an echo cancellation system. Contrary to the assertions of the Patent Office, Hirano uses a constant step size for the coefficient adaptation algorithm. [*see* Hirano, column 18, lines 1-4: "the FIR adaptive filters were constructed such that weighting coefficients for them were determined by a learning method (normalized LMS). *The step size μ was consequently 0.5*." (emphasis added)]

As Sugiyama does not disclose or suggest the application of a first-order leaky integration averaging method to the coefficients of the LMS algorithm, and Hirano does not disclose or suggest, either explicitly or implicitly, the motivation or desire to use a "first-order leaky integration" averaging method to update either the step size or the tap weight coefficients of the LMS algorithm, it is respectfully submitted that there is no teaching, suggestion or motivation, either explicitly or implicitly, to combine the references in the manner suggested by the Patent Office. Consequently, it is respectfully submitted that the Patent Office has not established a prima facie case of obviousness.

Rather, it is respectfully submitted that the Patent Office is using impermissible hindsight in an attempt to render the claims of the present application obvious. According to M.P.E.P. § 2142, "[t]o reach a proper determination under 35 U.S.C. 103, . . . impermissible hindsight must be avoided and the legal conclusion [of obviousness] must be reached on the

basis of the facts gleaned from the prior art." Furthermore, according to M.P.E.P. § 2143.01, "[t]he mere fact that references can be . . . modified does not render the resultant combination obvious unless the prior art also suggests the desirability of [such modification]." [citing *In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990)] Since the Patent Office has offered no proper support or motivation for combining these references, it is respectfully submitted that the rejection based on obviousness is founded upon "knowledge gleaned only from applicant's disclosure." [*see* M.P.E.P. § 2145] Consequently, it is respectfully submitted that the rejection entails hindsight and is, therefore, improper.

Independent claims 41, 50, 51, 60, 69, 70, 99, 102, 103, 107, 110 and 112 recite features similar to those recited in independent claim 32, and are, therefore, patentably distinguishable over the combination of Hirano and Sugiyama (with or without Bonnet) for at least those reasons stated above with regard to claim 32.

Dependent claims 33-35, 38, 42-44, 47, 52-54, 57, 61-63, 66, 71-73, 76, 79, 81, 83, 85, 87, 89, 91, 93, 95, 97, 100, 104, 105, 108, 113 and 114 variously depend from independent claims 32, 41, 50, 51, 60, 69, 70, 99, 102, 103, 107, 110 and 112, and are, therefore, patentably distinguishable over the combination of Hirano and Sugiyama (with or without Bonnet) for least those reasons stated above with regard to claims 32, 41, 50, 51, 60, 69, 70, 99, 102, 103, 107, 110 and 112.

For example, with regard to the rejection of claims 33-34, 42-43, 52-53, 61-62 and 71-72, it is respectfully submitted that the combination of Hirano and Sugiyama does not disclose or suggest the features of the corresponding coefficients from the previous time period are weighted by a first predetermined weighing factor, as recited in, for example, claim 33, or the product of the signal received by the receiver during the current period and

the signal transmitted by the transmitter delayed by the predetermined time are weighted by a second predetermined weighing factor, as recited in, for example, claim 34.

As acknowledged by the Patent Office, Hirano does not disclose or suggest "averaging the coefficient of the LMS algorithm" with a first and/or second predetermined weighting factor. As discussed previously, the coefficients of the adaptive filters disclosed by Hirano are updated according to a conventional LMS algorithm, in which each new filter coefficient is the sum of the previous coefficient and a product of an input signal, an error signal and a fixed step size (μ). [*see* Hirano, column 10, lines 13-45 and Equations 24 and 25] Therefore, it is respectfully submitted that Hirano does not disclose or suggest using predetermined weighting factors to update tap weight coefficients.

Furthermore, as discussed previously, Sugiyama discloses a first-order leaky integration averaging method for adaptively controlling the *step sizes* of the adaptive filter. Contrary to the assertions of the Patent Office, Sugiyama discloses that either a conventional LMS algorithm or a normalized LMS algorithm is used as the coefficient update algorithm. [*see* Sugiyama, column 21, lines 46-51] Therefore, it is respectfully submitted that Sugiyama does not disclose or suggest using predetermined weighting factors to update tap weight coefficients.

Dependent claims 42, 52, 61 and 71 recite features similar to those recited in dependent claim 33, and dependent claims 43, 53, 62 and 72 recite features similar to those recited in dependent claim 34, and are, therefore, patentably distinguishable over the combination of Hirano and Sugiyama (with or without Bonnet) for at least those reasons state above with regard to claims 33 and 34, respectively.

For example, with regard to the rejection of claims 35, 38, 44, 47, 54, 57, 63, 66, 73 and 76, it is respectfully submitted that the combination of Hirano and Sugiyama does not disclose or suggest the features of a first delay circuit to delay the signal transmitted by the transmitter, a first multiplier to multiply the signal received by the receiver during the current period with an output of said first delay circuit, a second multiplier to multiply an output of said first multiplier by a first predetermined weighting factor, a first adder, a second delay circuit to delay an output of said first adder, and a third multiplier to multiply an output of said second delay circuit by a second predetermined weighting factor, wherein said first adder adds an output of said second multiplier to an output of said third multiplier, as recited in, for example, claim 35.

As discussed previously, the coefficients of the adaptive filters disclosed by Hirano are updated according to a conventional LMS algorithm, in which each new filter coefficient is the sum of the previous coefficient and a product of an input signal, an error signal and a fixed step size (μ). [*see* Hirano, column 10, lines 13-45 and Equations 24 and 25] Consequently, it is respectfully submitted that Hirano does not disclose or suggest features to, for example, delay a transmitted signal (i.e., the first delay circuit), multiply a signal received by a receiver during the current time period with the delayed transmitted signal (i.e., the first multiplier), and multiply the result by a first predetermined weighting factor (i.e., a second multiplier), among other features.

In addition, as discussed previously, Sugiyama discloses a first-order leaky integration averaging method for adaptively controlling the *step sizes* of the adaptive filter. Contrary to the assertions of the Patent Office, Sugiyama discloses that either a conventional LMS algorithm or a normalized LMS algorithm is used as the coefficient update algorithm.

[*see* Sugiyama, column 21, lines 46-51] Consequently, it is respectfully submitted that Sugiyama does not disclose or suggest features to, for example, delay a transmitted signal (i.e., the first delay circuit), multiply a signal received by a receiver during the current time period with the delayed transmitted signal (i.e., the first multiplier), and multiply the result by a first predetermined weighting factor (i.e., a second multiplier), among other features.

Dependent claims 38, 44, 47, 54, 57, 63, 66, 73 and 76 recite features similar to those recited in dependent claim 35, and are, therefore, patentably distinguishable over the combination of Hirano and Sugiyama (with or without Bonnet) for at least those reasons state above with regard to claim 35, respectively.

For example, with regard to the rejection of claims 79, 81, 83, 85, 87, 89, 91, 93, 95, 97, 105 and 114, it is respectfully submitted that the combination of Hirano and Sugiyama does not disclose or suggest the feature of each of the plurality of filter coefficients being generated according to the formula:

$$C_J(k+1) = (1-\beta) * C_J(k) + \frac{\beta}{\sigma^2} * x(k+1) * b(k-j)$$

wherein:

$C_j(k)$ is the filter coefficient from the previous time period,

Cj(k+1) is the filter coefficient for the current time period,

x(k+1) is the signal received by the receiver during the current period,

b(k-j) is the signal transmitted by the transmitter delayed by **j** delay units,

(1-β) is a first leakage factor,

σ^2 is a variance of a transmitted symbol, and

β/σ^2 is a second leakage factor.

as recited in, for example, claim 79.

As discussed previously, the coefficients of the adaptive filters disclosed by Hirano are updated according to a conventional LMS algorithm, in which each new filter coefficient

is the sum of the previous coefficient and a product of an input signal, an error signal and a fixed step size (μ). [*see* Hirano, column 10, lines 13-45 and Equations 24 and 25] Consequently, it is respectfully submitted that Hirano does not disclose or suggest the generation of new filter coefficients from a weighted sum of corresponding coefficients from a previous time period, weighted by a first leakage factor, and a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time, weighted by a second leakage factor.

Furthermore, as discussed previously, Sugiyama discloses a first-order leaky integration averaging method for adaptively controlling the *step sizes* of the adaptive filter. Contrary to the assertions of the Patent Office, Sugiyama discloses that either a conventional LMS algorithm or a normalized LMS algorithm is used as the coefficient update algorithm. [*see* Sugiyama, column 21, lines 46-51] Consequently, it is respectfully submitted that Sugiyama does not disclose or suggest the generation of new filter coefficients from a weighted sum of corresponding coefficients from a previous time period, weighted by a first leakage factor, and a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time, weighted by a second leakage factor.

Dependent claims 81, 83, 85, 87, 89, 91, 93, 95, 97, 105 and 114 recite features similar to those recited in dependent claim 79, and are, therefore, patentably distinguishable over the combination of Hirano and Sugiyama (with or without Bonnet) for at least those reasons state above with regard to claim 79, respectively.

For example, with regard to the rejection of claims 104, 108 and 113, it is respectfully submitted that the combination of Hirano and Sugiyama does not disclose or suggest the

feature of a Finite Impulse Response (FIR) filter in communication with the receiver and the LMS engine, wherein the FIR filter reproduces the near-end echo and near-end crosstalk interference in the signal received by the receiver *in accordance with the plurality of filter coefficients generated by the LMS engine*, as recited, for example, in claim 104. Applicant respectfully notes that the LMS engine generates each of the plurality of filter coefficients using a sum of a corresponding coefficient from a previous time period weighted by a first leakage factor and a product of a signal received by the receiver during the current time period and a time-delayed signal transmitted by the transmitter, in which the product is weighted by a second leakage factor. [*see, e.g.*, present application, claim 103 from which claim 104 depends]

As discussed previously, the coefficients of the adaptive filters disclosed by Hirano are updated according to a conventional LMS algorithm, in which each new filter coefficient is the sum of the previous coefficient and a product of an input signal, an error signal and a fixed step size (μ). [*see* Hirano, column 10, lines 13-45 and Equations 24 and 25]

Additionally, as discussed previously, Sugiyama discloses a first-order leaky integration averaging method for adaptively controlling the *step sizes* of the adaptive filter. Contrary to the assertions of the Patent Office, Sugiyama discloses that either a conventional LMS algorithm or a normalized LMS algorithm is used as the coefficient update algorithm. [*see* Sugiyama, column 21, lines 46-51 (emphasis added)]

Dependent claims 108 and 113 recite features similar to those recited in dependent claim 104, and are, therefore, patentably distinguishable over the combination of Hirano and Sugiyama (with or without Bonnet) for at least those reasons state above with regard to claim 104, respectively.

For at least the foregoing reasons, it is respectfully submitted that the combination of Hirano and Sugiyama (with or without Bonnet) does not render the subject matter of claims 32-35, 38, 41-44, 47, 50, 51-54, 57, 60-63, 66, 69, 70-73, 76, 79, 81, 83, 85, 87, 89, 91, 93, 95, 97, 99, 100, 102, 103-105, 107-108, 110 and 112-114 obvious. Accordingly, reconsideration and withdrawal of these grounds of rejection are respectfully requested.

V. 35 U.S.C. § 103(a) REJECTIONS BASED ON TRAILL AND SUGIYAMA

In the twelfth section of the Office Action, claims 32, 38, 51, 57, 70 and 76 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Traill et al. (U.S. Patent No. 6,078,567, hereinafter "Traill") in view of Sugiyama. This rejection is respectfully traversed.

Traill discloses an echo detecting system that includes data stores for storing signals from up and down channels respectively. The signals undergo pre-processing to identify signal forms characteristic of speech, and instruct a measurement unit to carry out comparison using cross-correlation techniques between the signals stored in the stores only when such characteristics are detected. More particularly, a transmitted is compared with a reflected signal to calculate a cross-correlation coefficient. The transmitted signal is then delayed by one unit of time and the cross-correlation coefficient re-calculated. When the delayed transmit signal and the reflected signal are equal, the cross-correlation coefficient will be approximately unity. [*see* Traill, column 6, lines 1-18] An echo cancellation signal is generated using the cross-correlation measurement by "canceller 7 or 17 by extracting the input signal from buffer 8 or 18 respectively, attenuating and delaying it by amounts

equivalent to the detected echo signal as measured in unit 12 and applying to the return path 15 or 5 respectively a signal corresponding to the result of this process but out of phase with the detected signal by 180°. This applied signal is combined in combiners 13, 14 respectively with the echo arriving on the return path 5 or 15 to produce a zero output." [Traill, column 6, line 60 – column 7, line 3]

Furthermore, as disclosed by Traill,

> [s]peech signals consist of voiced and unvoiced segments. The voiced segments are high in energy and the samples are auto-correlated in contrast to the lower energy noise-like samples in the unvoiced segments. These characteristics result in a poor convergence rate of *the LMS (least mean squares) algorithm used by the DAF*. As the unvoiced segments are low in energy they tend to be corrupted by echo path noise, so the properties of the higher energy voiced segments have been exploited to improve the performance of the LMS algorithm. In order to do this the delayed incident signal is supplied to *an LPC (linear predictive coding) analysis unit 24* which derives the coefficients of a filter H(z) having a frequency response similar to the frequency spectrum of the incident signal. Such analysis is well-known in the art. Essentially it generates a series of coefficients which, when applied to a white noise signal, reproduce the voiced sound that was modelled. In this way it simulates the effect of the vocal tract on the essentially white noise input to it by the speaker's lungs and windpipe. [Traill, column 9, lines 43-61 (emphasis added)]

Thus, Traill discloses the use of a conventional LMS algorithm and a linear predictive coder to generate the tap weight coefficients.

However, the Patent Office notes that "[i]nherently, Traill et al teaches an adaptation algorithm. For example, Bonnet et al. (US 4,852,081) shows a typical form of an adaptation algorithm . . . ." [Office Action, page 3] Again, the Applicant does not disagree with the Patent Office that Traill teaches an adaptation algorithm – Traill merely teaches *a conventional LMS algorithm* for updating tap weight coefficients, supplemented by a linear predictive coder. As discussed previously, according to Bonnet, the filter coefficients are

updated according to Equation 4 or 5, which are conventional LMS algorithms, in which each new filter coefficient is the sum of the previous coefficient and a product of an input signal, an error signal and a fixed step size (μ). [*See* Bonnet, column 2, lines 14-53]

In addition, the Patent Office notes that Traill refers to Taguchi (U.S. Patent No. 5,062,102, hereinafter "Taguchi"). Taguchi discloses a data transmission system in which a first signal partially leaks as an echo from a first transmission line to a second transmission line through a hybrid circuit to form a mixed signal of the echo and a second signal on the second transmission line. An echo canceller is used for canceling the echo by producing an echo replica at a transversal filter according to filter coefficients and subtracting the echo replica from the mixed signal. [*See* Taguchi, Abstract] The filter coefficients are determined according to Equation 5, which is a *linear prediction algorithm*. [*See* Taguchi, column 5, line 67 – column 6, line 47]

Therefore, it is respectfully submitted Traill does not disclose or suggest the feature of an adaptive correlator that generates a plurality of filter coefficients for canceling near-end echo and near-end crosstalk, in which each new filter coefficient is a weighted sum of corresponding coefficients from a previous time period and *a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time*, as recited, for example, in claim 32 of the present application.

As discussed previously, Sugiyama discloses a first-order leaky integration averaging method for adaptively controlling the *step sizes* of the adaptive filter. Contrary to the assertions of the Patent Office, Sugiyama discloses that either a conventional LMS algorithm or a normalized LMS algorithm is used as the coefficient update algorithm: "the *LMS algorithm* has been assumed for coefficient adaptation. However, other algorithms may be

used in the present invention. For instance, the eighteenth embodiment can be implemented by using the *normalized LMS (NLMS) algorithm . . . .*" [Sugiyama, column 21, lines 46-51 (emphasis added)]

Consequently, as Sugiyama does not disclose or suggest the feature of an adaptive correlator that generates a plurality of filter coefficients for canceling near-end echo and near-end crosstalk, in which each new filter coefficient is a weighted sum of corresponding coefficients from a previous time period and *a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time*, it is respectfully submitted that Sugiyama does not address the above-identified deficiencies of Traill (or Bonnet or Taguchi).

As neither Traill nor Sugiyama discloses or suggests the feature of an adaptive correlator that generates new filter coefficients from a weighted sum of corresponding coefficients from a previous time period and *a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time*, it is respectfully submitted that the combination of Traill and Sugiyama (with or without Bonnet and/or Taguchi) does not render the subject matter of claim 32 obvious.

Furthermore, the Patent Office asserts that "it would have been obvious to a person of ordinary skill in the art to apply the first-order leaky integration to the coefficient of the LMS algorithm of Traill et al in order to obtain a stable value (i.e., **averaged value**) of the LMS coefficient in the presence of noise in an echo cancellation system." [present Office Action, page 11 (emphasis in original)] It is respectfully submitted that there is absolutely no

suggestion or motivation, either implicitly or explicitly, to combine Traill and Sugiyama in the manner suggested by the Patent Office.

As discussed previously, Sugiyama discloses that the "first-order leaky integration" averaging techniques are applied to the step-size to improve the noise resistance in the adaptive coefficient control. [*see* Sugiyama, column 7, lines 3-5] It is respectfully submitted that Sugiyama does not disclose or suggest the use of the "first-order leaky integration" averaging method to update the tap weight coefficients of the LMS algorithm to obtain average values of the LMS coefficients. Rather, a conventional LMS or NLMS algorithm is used to update the tap weight coefficients.

In addition, it is respectfully submitted that *nowhere* does Traill, either explicitly or implicitly, disclose or suggest a need or desire to use such an adaptive step size in the LMS algorithm to combat noise. As discussed previously, it is respectfully submitted that there is no support in Sugiyama or Traill, either explicitly or implicitly, for the Patent Office's alleged motivation to apply the first-order leaky integration averaging method to the coefficients of the LMS algorithm to obtain a stable (i.e., averaged) value of the LMS coefficients in the presence of noise in an echo cancellation system. Contrary to the assertions of the Patent Office, Traill discloses the use of a conventional LMS algorithm and a linear predictive coder to generate the tap weight coefficients. [*see* Traill, column 9, lines 43-61]

As Sugiyama does not disclose or suggest the application of a first-order leaky integration averaging method to the coefficients of the LMS algorithm, and Traill does not disclose or suggest, either explicitly or implicitly, the motivation or desire to use a "first-order leaky integration" averaging method to update either the step size or the tap weight

coefficients of the LMS algorithm, it is respectfully submitted that there is no teaching, suggestion or motivation, either explicitly or implicitly, to combine the references in the manner suggested by the Patent Office. Consequently, it is respectfully submitted that the Patent Office has not established a prima facie case of obviousness.

Rather, it is respectfully submitted that the Patent Office is using impermissible hindsight in an attempt to render the claims of the present application obvious. Since the Patent Office has offered no proper support or motivation for combining these references, it is respectfully submitted that the rejection based on obviousness is founded upon "knowledge gleaned only from applicant's disclosure." [*see* M.P.E.P. § 2145] Consequently, it is respectfully submitted that the rejection entails hindsight and is, therefore, improper.

Independent claims 51 and 70 recite features similar to those recited in independent claim 32, and are, therefore, patentably distinguishable over the combination of Traill and Sugiyama (with or without Bonnet and/or Taguchi) for at least those reasons stated above with regard to claim 32.

Dependent claims 38, 57 and 76 variously depend from independent claims 32, 51 and 70, and are, therefore, patentably distinguishable over the combination of Traill and Sugiyama (with or without Bonnet and/or Taguchi) for least those reasons stated above with regard to claims 32, 51 and 70.

For example, with regard to the rejection of claims 38, 57 and 76, it is respectfully submitted that the combination of Traill and Sugiyama (with or without Bonnet and/or Taguchi) does not disclose or suggest the features of a first delay circuit to delay the signal transmitted by the transmitter, a first shifter to shift the signal received by the receiver during the current period in accordance with an output of said first delay circuit, a second shifter to

shift an output of said first shifter in accordance with a first predetermined weighting factor, a first adder, a third shifter to shift an output of said first adder in accordance with a second predetermined weighting factor, a second adder; and a second delay circuit to delay an output of said second adder, in which the first adder adds an output of said second shifter to an output of said second delay circuit, and in which the second adder adds an output of said third shifter to the output of the second delay circuit, as recited, for example, in claim 38.

As discussed previously, the tap weight coefficients of the filters disclosed by Traill are updated according to a conventional LMS algorithm a linear predictive coder. [*see* Traill, column 9, lines 43-61] Consequently, it is respectfully submitted that Traill does not disclose or suggest features to, for example, delay a transmitted signal (i.e., the first delay circuit), shift a signal received by a receiver during the current time period in accordance with an output of the first delay circuit (i.e., the first shifter), and shift the result by a first predetermined weighting factor (i.e., a second shifter), among other features.

In addition, as discussed previously, Sugiyama discloses a first-order leaky integration averaging method for adaptively controlling the *step sizes* of the adaptive filter. Contrary to the assertions of the Patent Office, Sugiyama discloses that either a conventional LMS algorithm or a normalized LMS algorithm is used as the coefficient update algorithm. [*see* Sugiyama, column 21, lines 46-51 (emphasis added)] Consequently, it is respectfully submitted that Sugiyama does not disclose or suggest features to, for example, delay a transmitted signal (i.e., the first delay circuit), shift a signal received by a receiver during the current time period in accordance with an output of the first delay circuit (i.e., the first shifter), and shift the result by a first predetermined weighting factor (i.e., a second shifter),

among other features. Therefore, it is respectfully submitted that Sugiyama does not address the above-identified deficiencies of Traill (or Bonnet or Taguchi).

Dependent claims 57 and 76 recite features similar to those recited in dependent claim 38, and are, therefore, patentably distinguishable over the combination of Traill and Sugiyama (with or without Bonnet and/or Taguchi) for at least those reasons state above with regard to claim 38.

For at least the foregoing reasons, it is respectfully submitted that the combination of Traill and Sugiyama (with or without Bonnet and/or Taguchi) does not render the subject matter of claims 32, 38, 51, 57, 70 and 76 obvious. Accordingly, reconsideration and withdrawal of these grounds of rejection are respectfully requested.

VI. 35 U.S.C. § 103(a) REJECTIONS BASED ON HIRANO, SUGIYAMA AND CHEVREAU

In the thirteenth section of the Office Action, claims 36, 39, 45, 48, 55, 58, 64, 67, 74 and 77 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over the combination of Hirano and Sugiyama in view of Chevreau et al. (U.S. Patent No. 4,571,720, hereinafter "Chevreau"). This rejection is respectfully traversed.

As discussed previously, neither Hirano nor Sugiyama discloses or suggests the feature of an adaptive correlator that generates new filter coefficients from a weighted sum of corresponding coefficients from a previous time period and *a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time*. Furthermore, as discussed previously, it is respectfully submitted that there is no teaching, suggestion or motivation, either explicitly or implicitly, to combine

Hirano and Sugiyama in the manner suggested by the Patent Office. In addition, as acknowledged by the Patent Office, neither Hirano nor Sugiyama discloses or suggests the feature of "using an inverse of a variance of the signal transmitted by the transmitter." [present Office Action, page 13]

Chevreau discloses a method and apparatus for reducing the convergence time of an echo canceller including a transversal filter having N adjustable complex coefficients. According to Chevreau, a complex training signal is periodically transmitted. After the transmission of at least N data of the training signal, the coefficients of the transversal filter are calculated from the sequence formed by the next L data transmitted using the following Equation (3):

$$\vec{C} = \vec{C}_0 + \frac{2}{(L+1)\sigma^2} \sum_{n=0}^{L-1} e_R(n)\vec{D}^*(n) \qquad (3)$$

In Equation (3), $\vec{C}$ is the vector of the N coefficients obtained at the end of the calculation, $\vec{C}_0$ is the vector of initial coefficients, $e_R(n)$ is the difference signal, $\vec{D}^*(n)$ is the vector of complex conjugate values of the last N data entering the transversal filter, and σ^2 is a constant term representing the power of each of the transmitted data. [*see* Chevreau, column 3, line 57 – column 4, line 26] According to Chevreau, "[i]n practice, the initial coefficients $\vec{C}_0$ of the transversal filter are set to zero, which additionally makes it possible to substitute the received signal $\varepsilon_R(n)$ for the difference signal $e_R(n)$ in the formula for calculating the coefficients." [Chevreau, column 4, lines 27-31] It is respectfully submitted that Chevreau does not disclose or suggest an adaptive correlator that generates a plurality of filter coefficients for canceling near-end echo and near-end crosstalk, in which each new filter

coefficient is a weighted sum of corresponding coefficients from a previous time period and *a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time.* Therefore, Chevreau does not address the above-identified deficiencies of Hirano and Sugiyama.

As neither Hirano, Sugiyama nor Chevreau discloses or suggests the feature of an adaptive correlator that generates new filter coefficients from a weighted sum of corresponding coefficients from a previous time period and *a product of a signal received by the receiver during the current period and a signal transmitted by the transmitter delayed by a predetermined time*, it is respectfully submitted that the combination of Hirano, Sugiyama and Chevreau does not render the subject matter of claims 36, 39, 45, 48, 55, 58, 64, 67, 74 and 77 obvious.

Furthermore, the Patent Office asserts that "it would have been obvious to a person of ordinary skill in the art to define and determine a suitable normalization factor to meet the performance specification of the echo canceller subject to circuit, system and design constraints." [present Office Action, page 13] It is respectfully submitted that there is absolutely no suggestion or motivation, either implicitly or explicitly, to combine Hirano, Sugiyama and Chevreau in the manner suggested by the Patent Office.

For example, as discussed previously, the coefficients of the adaptive filters disclosed by Hirano are updated according to a conventional LMS algorithm, in which each new filter coefficient is the sum of the previous coefficient and a product of an input signal, an error signal and a fixed step size (μ). As Hirano does not disclose or suggest, either explicitly or implicitly, the use of a "suitable normalization factor to meet the performance specification of the echo canceller subject to circuit, system and design constraints" to update the tap

weight coefficients of the LMS algorithm, it is respectfully submitted that there is no teaching, suggestion or motivation, either explicitly or implicitly, to combine the references in the manner suggested by the Patent Office. Consequently, it is respectfully submitted that the Patent Office has not established a prima facie case of obviousness.

Rather, it is respectfully submitted that the Patent Office is using impermissible hindsight in an attempt to render the claims of the present application obvious. Since the Patent Office has offered no proper support or motivation for combining these references, it is respectfully submitted that the rejection based on obviousness is founded upon "knowledge gleaned only from applicant's disclosure." [*see* M.P.E.P. § 2145] Consequently, it is respectfully submitted that the rejection entails hindsight and is, therefore, improper.

In addition, with regard to the rejection of claims 36, 45, 55, 64 and 74, as discussed previously, the coefficients of the adaptive filters disclosed by Hirano are updated according to a conventional LMS algorithm, in which each new filter coefficient is the sum of the previous coefficient and a product of an input signal, an error signal and a fixed step size (μ). [*see* Hirano, column 10, lines 13-45 and Equations 24 and 25] In addition, as discussed previously, Sugiyama discloses a first-order leaky integration averaging method for adaptively controlling the *step sizes* of the adaptive filter. Contrary to the assertions of the Patent Office, Sugiyama discloses that either a conventional LMS algorithm or a normalized LMS algorithm is used as the coefficient update algorithm. [*see* Sugiyama, column 21, lines 46-51 (emphasis added)] Consequently, neither Hirano nor Sugiyama disclose or suggest the use of predetermined weighting factors to update the tap weight coefficients. Furthermore, with respect to Chevreau, as can be seen from Equation (3) above, $\vec{C}_0$ is not weighted by any predetermined weighting factor, and the term "$2/((L+1)\sigma^2)$" is not a first predetermined

weighting factor comprised of a quotient of the second predetermined weighting factor divided by a variance of the signal transmitted by the transmitter.

Therefore, it is respectfully submitted that the combination of Hirano, Sugiyama and Chevreau does not disclose or suggest the feature of the first predetermined weighting factor being a quotient of the second predetermined weighting factor divided by a variance of the signal transmitted by the transmitter, as recited in, for example, claims 36, 45, 55, 64 and 74.

For at least the foregoing reasons, it is respectfully submitted that the combination of Hirano, Sugiyama and Chevreau does not render the subject matter of claims 36, 39, 45, 48, 55, 58, 64, 67, 74 and 77 obvious. Accordingly, reconsideration and withdrawal of these grounds of rejection are respectfully requested.

VI. 35 U.S.C. § 103(a) REJECTIONS BASED ON HIRANO, SUGIYAMA AND CHEVREAU

In the fourteenth section of the Office Action, claims 37, 40, 46, 49, 56, 59, 65, 68, 75, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 101, 106, 109, 111 and 115 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over the combination of Hirano and Sugiyama. This rejection is respectfully traversed.

Applicant respectfully notes that the Patent Office has previously acknowledged that Hirano does not disclose or suggest "averaging the coefficient of the LMS algorithm" with a first and/or second predetermined weighting factor. As discussed previously, the coefficients of the adaptive filters disclosed by Hirano are updated according to a conventional LMS algorithm, in which each new filter coefficient is the sum of the previous coefficient and a product of an input signal, an error signal and a fixed step size (μ). [*see* Hirano, column 10,

lines 13-45 and Equations 24 and 25] Therefore, it is respectfully submitted that Hirano does not disclose or suggest a second predetermined weighting factor used for updating the tap weight coefficients that is an inverse of a number of a group of the signals transmitted by the transmitter.

Furthermore, as discussed previously, Sugiyama discloses a first-order leaky integration averaging method for adaptively controlling the *step sizes* of the adaptive filter. Contrary to the assertions of the Patent Office, Sugiyama discloses that either a conventional LMS algorithm or a normalized LMS algorithm is used as the coefficient update algorithm. [*see* Sugiyama, column 21, lines 46-51 (emphasis added)] Therefore, it is respectfully submitted that Sugiyama does not disclose or suggest a second predetermined weighting factor used for updating the tap weight coefficients that is an inverse of a number of a group of the signals transmitted by the transmitter.

The Patent Office asserts that "it would have been obvious to a person of ordinary skill in the art to determine a suitable design parameter, β, to meet the performance specification of the echo canceller subject to circuit, system and design constraints." [present Office Action, page 14] It is respectfully submitted that there is absolutely no suggestion or motivation, either implicitly or explicitly, to combine Hirano and Sugiyama in the manner suggested by the Patent Office. For example, as neither Hirano nor Sugiyama disclose or suggest the use of predetermined weighting factors to update the tap weight coefficients, it is respectfully submitted that there is no teaching, suggestion or motivation, either explicitly or implicitly, to combine the references in the manner suggested by the Patent Office. Consequently, it is respectfully submitted that the Patent Office has not established a prima facie case of obviousness.

Rather, it is respectfully submitted that the Patent Office is using impermissible hindsight in an attempt to render the claims of the present application obvious. Since the Patent Office has offered no proper support or motivation for combining these references, it is respectfully submitted that the rejection based on obviousness is founded upon "knowledge gleaned only from applicant's disclosure." [*see* M.P.E.P. § 2145] Consequently, it is respectfully submitted that the rejection entails hindsight and is, therefore, improper.

For at least the foregoing reasons, it is respectfully submitted that the combination of Hirano and Sugiyama does not render the subject matter of claims 37, 40, 46, 49, 56, 59, 65, 68, 75, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 101, 106, 109, 111 and 115 obvious. Accordingly, reconsideration and withdrawal of these grounds of rejection are respectfully requested.

VII. CONCLUSION

All of the rejections raised in the Office Action having been addressed, it is respectfully submitted that the present application is in condition for allowance and a notice to that effect is earnestly solicited. Should the Examiner have any questions regarding this response or the application in general, the Examiner is urged to contact the Applicant's attorney, Andrew J. Bateman, by telephone at (202) 625-3547. All correspondence should continue to be directed to the address given below.

Respectfully submitted,

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